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Control of Cherry Leaf Spot in Wisconsin

G. W. KEITT

SPRAYING—THE DIFFERENCE BETWEEN SUCCESS AND FAILURE

The twig in the center was from an unsprayed tree. The leaves were lost early and the fruit did not mature. The other twigs were from trees which had received two thorough and timely applications of spray. The foliage remained healthy and a heavy crop of fruit ripened normally.

AGRICULTURAL EXPERIMENT STATION
OF THE UNIVERSITY OF WISCONSIN

MADISON

DIGEST

Leaf spot is the most destructive fungus disease of the cherry in Wisconsin. Its control is necessary for profitable commercial cherry culture in this state. Page 3

The scarcity and high price of copper sulphate and labor make it highly important to improve control measures. Page 4

Early clean cultivation greatly reinforces the spraying program by checking the development and discharge of spores of the leaf spot fungus. Pages 6–7

Two or three applications of Bordeaux mixture or lime-sulphur, with arsenate of lead, combined with early clean cultivation, will satisfactorily control leaf spot. Make the applications: first, soon after the petals fall; second, about 2 weeks later; and third, just after the fruit is harvested. The third application may frequently be omitted, but never the first or second. Pages 7–9

Weaker Bordeaux mixtures may be used where the spraying is thoroughly done. The 3-3-50 strength may be used with full confidence. With good sanitation and thorough application, even the 2-2-50 formula may be used with safety. Page 10

Lime-sulphur, 33° B. (1.2946 sp. gr.); should be diluted at the rate of 1-40 or 1-30. Add arsenate of lead (powder, ½ to 1 lb. in 50 gals.; paste, 1 to 2 lbs.) to control chewing insects and to increase the effectiveness of the spray against leaf spot. Pages 7-11

Control of Cherry Leaf Spot in Wisconsin*

G. W. KEITT

Leaf spot is the most serious fungus disease of the cherry in Wisconsin. Its control is necessary for profitable commercial cherry culture in this state.

FIG. 1.—CHERRY LEAF SPOT

Diseased leaves bear roundish brown spots, on the under surfaces of which "blisters" usually develop (right figure). These "blisters" are filled with spores, which rapidly spread the disease. Such leaves usually turn yellow before they fall. Often the dead areas fall out and a "shothole" effect results.

For many years Wisconsin orchardists have been able to control this disease by persistent spraying with Bordeaux mixture. However, the time and number of applications and the concentration of the spray necessary for the best and most economical results have remained to be determined. Furthermore,

* The matter presented in this bulletin is to be accepted as a report of progress based upon two seasons' work. It was Dr. Keitt's plan to continue this work for a third season and present the detailed data in a research bulletin. Owing to his absence in war service it has seemed best in order to meet the practical needs of the fruit growers to publish the essential results in the present form. When conditions permit it is expected that the investigations will be completed and the full data published as originally planned.

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the recent high prices of copper sulphate and the scarcity of labor have made it extremely important to reduce the cost and labor of control measures and to develop, in case of need, a control program which is independent of Bordeaux mixture. For three years these problems have been under investigation by the Department of Plant Pathology of the University of Wis-

FIG. 2.—EARLY CLEAN CULTIVATION PROTECTED THIS TREE

The development of leaf spot was checked by turning under the dead leaves in early spring before the fungus in them could discharge its spores. Early clean cultivation strongly reenforces spraying, but will not take its place. (Photographed July 27, 1916.)

consin. A field station has been maintained at Sturgeon Bay where extensive field and laboratory studies and spraying experiments have been conducted.

THE NATURE OF LEAF SPOT INJURY

The leaf spot disease affects not only the foliage, but also the fruit and fruit stems. On the leaves, it appears as small roundish brown spots which often occur so abundantly that they run together and form large irregular dead patches. Under certain conditions, the dead spots drop out and on account of the resulting appearance of the leaves the disease has often been called "shot hole". Badly affected leaves ordinarily

turn yellow and drop. This has led many to call the disease "yellow leaf". It should be borne in mind, however, that certain other troubles may show very similar symptoms, and that there is danger of confusing leaf spot with other foliage injuries. On the fruit and the fruit stems the disease appears as small brownish or reddish spots. The chief injury to the fruit,

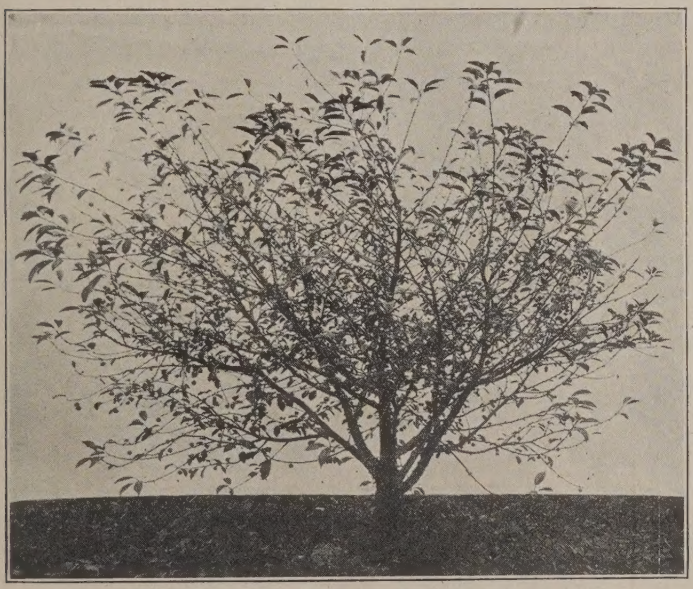

FIG. 3.—LACK OF EARLY CLEAN CULTIVATION ALLOWED LEAF SPOT TO DEVELOP

This tree received no early clean cultivation. Otherwise it was treated as the tree shown in Figure 2, which was in the same orchard. Compare. (Photographed July 27, 1916.

however, results from the loss of vitality of the tree, due to loss of leaves. In cases of severe attacks, the fruit often fails to mature, and wood and bud formation are seriously hindered. Repeated severe attacks may kill the tree.

Leaf spot is caused by a fungus. This parasite lives in the diseased parts of the cherry plant in the summer and passes the winter in the dead leaves on the ground. In the spring it produces spores ("winter spores") which are shot into the air. Some of these lodge on living cherry leaves. Here they germinate, grow into the leaf, and produce the disease. On the under surfaces of the resulting spots, small "blisters" usually de-

velop. These break open, and a whitish material oozes out. This is made up of thousands of spores of another type ("summer spores") which spread the disease very rapidly.

EARLY CLEAN CULTIVATION

Leaf spot may be fought by means other than spraying. The weakest point in the life history of the leaf spot fungus occurs when it passes the winter in the dead leaves on the ground.

FIG. 4.—UNSPRAYED TREE AT THE END OF THE SEASON

This tree lost its leaves in early summer. The fruit failed to mature and was a total loss, much of it hanging on until frost. (Photographed Sept. 29, 1917.)

If all these dead leaves could be destroyed and if the fungus harbored on no other plants, spraying would not be necessary. While it is not practicable to practice sanitation with such thoroughness as to make spraying unnecessary, it is possible greatly to strengthen the spray schedule by turning under as many of these leaves as is feasible by clean cultivation in the spring before the spores of the fungus are discharged. Our studies of the fungus have shown that "winter spores" usually begin to be discharged at about the time the blossom buds of the cherry begin to break open. Clean cultivation should precede this period. Most Wisconsin growers cultivate before

this time anyway. Therefore, much may be gained with little additional expense by making the cultivation as clean as is practicable instead of leaving unturned strips or large blocks about the bases of trees.

SPRAYING

In 1916 and 1917, extensive spraying experiments were conducted in commercial orchards in cooperation with growers. In both seasons the disease developed very severely in early summer and was very destructive until about picking time, after which it made relatively little progress.

The spray to use. The following sprays were tested comparatively: Bordeaux mixture (various strengths), lime-sulphur (various strengths), self-boiled lime-sulphur (8 lbs. lime and 8 lbs. sulphur in 50 gals.), "atomic sulphur" (5 lbs. in 50 gals.), and "barium sulphur" (3 lbs. in 50 gals.) Four applications were made, approximately as follows: (1) when the blossom buds showed white, just before blooming, (2) just after the petals fell, (3) about two weeks later, and (4) just after the fruit was harvested. Similar tests were made in which the first treatment was omitted. Arsenate of lead powder (¾ to 1 lb. in 50 gals.) was added to the fungicide in each application.

Bordeaux mixture and lime-sulphur controlled the disease very satisfactorily. The other sprays tested failed to control the disease satisfactorily. The results in the two years were confirmatory. It is evident from these experiments that, under Wisconsin conditions, either Bordeaux mixture or lime-sulphur in combination with arsenate of lead, properly applied, will satisfactorily control leaf spot. In these experiments, however, lime-sulphur without arsenate of lead gave distinctly less satisfactory results than when the arsenate was added.

The time and number of treatments. Bordeaux mixture (4-4-50, that is, 4 lbs. copper sulphate and 4 lbs. stone lime in 50 gals., in 1916 and 3-3-50 in 1917) and lime-sulphur (1-40, that is, 1. gal. 33° B. —1.2946 sp. gr.—commercial concentrate in 40 gals.), both with arsenate of lead, were applied, approximately as follows: (1) when the blossom buds showed white, just before blooming, (2) soon after the petals fell, (3) about two weeks later, and (4) just after the fruit was harvested. On trees which received all four treatments, the disease was

controlled excellently. Where the treatment before the blossoms opened was omitted, the control was as satisfactory as that which resulted from the full four treatments. When the second or third treatment was omitted, the control was not satisfactory and much foliage was lost. Where the last treatment was omitted, the results were practically as good as where it

FIG. 5.—SPRAYED TWICE WITH BORDEAUX MIXTURE

Leaf spot on this tree was controlled by applying Bordeaux mixture, 3-3-50, with arsenate of lead, about six days after the petals fell and again about two weeks later. Compare with figures 4, 6, and 7. (Photographed Sept. 29, 1917.)

was applied. Both in 1916 and 1917, two treatments applied (1) soon after the petals fell and (2) about two weeks later, gave excellent commercial control. In some cases it may be advisable to make the application after picking the fruit, but ordinarily these two treatments, thoroughly applied and reenforced by thorough early clean cultivation, will be sufficient. They will not be sufficient if the work is not well done.

The timing of the first of these treatments is a very important practical matter. The greatest efficiency results when this spray is delayed as long as safety permits, because this ensures the covering of the greatest practicable amount of the

rapidly increasing leaf surface. However, if the application is too long delayed, the disease will not be controlled. Our experiments show that in such seasons as those of 1915, 1916, and 1917, in all of which leaf spot was very severe, the first treatment may be made with safety at any time during the week after most of the petals have fallen. Where thorough sanitation

FIG. 6.—SPRAYED TWICE WITH LIME-SULPHUR

Leaf spot on this tree was controlled by applying lime-sulphur, 1–40, with arsenate of lead, about six days after the petals fell and again about two weeks later. Compare with figures 4, 5, and 7. (Photographed Sept. 29, 1917.)

is practiced and no important source of infection is near, this period may be slightly extended. Within these limits, the timing of the first treatment should be determined by the individual grower to meet his local conditions. In the larger orchards where spraying equipment is used at its full capacity, it may be necessary to work through the entire range of the safety period. The smaller orchardist who may wish to increase the effectiveness of his spray by a slight delay after the falling of the petals must take into account the possibilities of further delay by unfavorable weather conditions. In case unusually warm weather occurs during or immediately following

the blooming period, the first treatment should be applied as soon as practicable after most of the petals are off.

The concentration of the spray. In 1916 and 1917 plats were sprayed comparatively with Bordeaux mixture, 4-4-50, 3-3-50, 2-2-50, and 1-1-50, and lime-sulphur, 1-30, 1-40, and 1-50. In each case arsenate of lead (powder,¾ to 1 lb. in 50 gals.) was added to the fungicide.

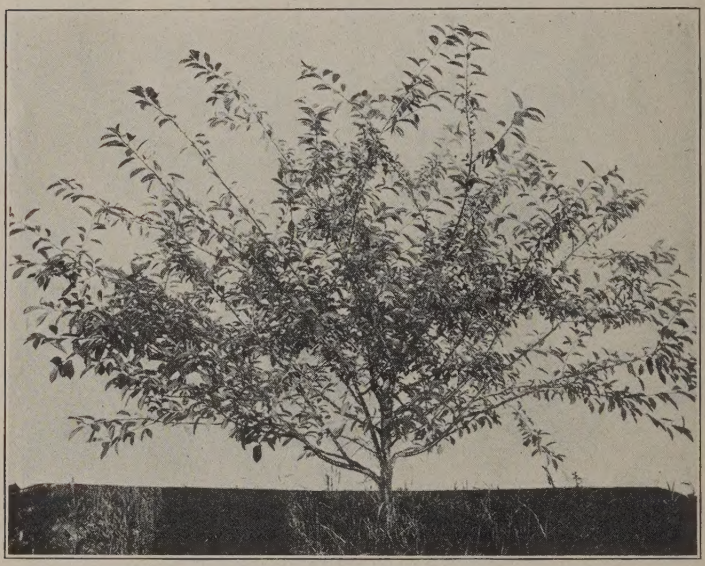

FIG. 7.—RESULTS OF PROLONGED DELAY OF THE FIRST SPRAY TREATMENT

This tree was treated like the one in Figure 5, except the first spray was delayed four days longer. There was a serious early development of leaf spot and much foliage was lost before the spray checked the disease. (Photographed Aug. 9, 1917.)

Bordeaux mixture 3-3-50 and 2-2-50 gave as satisfactory results as did the 4-4-50. Even the 1-1-50 formula gave a fair control in 1916 and a good commercial control in 1917. It is, however, too weak to be recommended for commercial use. These experiments show that the 3-3-50 formula may be recommended with full confidence for commercial use in Wisconsin cherry orchards. Even the 2-2-50 formula may be used with safety if good sanitation is practiced and the applications are thorough and timely. It will not be satisfactory, however, if the work is not well done.

Lime-sulphur, at all the three concentrations used, gave satisfactory results. As no injury resulted from the higher concentrations and the spray is relatively inexpensive, it seems best to use either the 1-40 or the 1-30 dilution. The 1-50 dilution is not recommended. Lime-sulphur 1-40 has been used more extensively in these experiments than any other dilution, and has given uniformly good results. In all these tests lime-sulphur was used in combination with arsenate of lead. When it was applied alone the results were less satisfactory.

RECOMMENDATIONS

No single recommendation can be made to meet the needs of all growers. The following program, however, subject to modifications to meet local conditions, should give satisfactory results:

1. **Give early clean cultivation.** Turn under the dead leaves in the spring as completely as practicable well before the blossoming period of the cherry. This will destroy a very large percentage of the "winter spores" of the fungus and thus strongly reenforce the spray schedule.

2. **Spray** with Bordeaux mixture, 3-3-50 (this formula should be modified to suit local conditions) or lime-sulphur, 1-40 or 1-30: (1) when the petals fall (timing subject to slight modification: see pp. 8–10, (2) about two weeks later, and (3), if necessary, just after the fruit is picked. In each application, arsenate of lead (powder, ¾ to 1 lb.; paste, 1½ to 2 lbs. in 50 gals.) should be added to the fungicide. This controls chewing insects and increases the effectiveness of the spray against leaf spot. The applications should be thorough and timely, especially in the case of lime-sulphur, and care should be taken to cover the under as well as the upper surfaces of the leaves. If good sanitation is practiced and the first and second applications are thorough, the third treatment may frequently be omitted. Whether or not it should be applied is a matter to be decided by the individual orchardist in the light of local conditions.

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